CLAIMS

1. A chemically reactive surface reactive with a substance comprising a hydroxyl group or amine group comprising:

a solid surface having an activated dendrimer polyamine covalently bonded to said surface through a silane containing moiety, said dendrimer polyamine comprising branch points and terminal residues, a said branch point of said dendrimer comprising either a secondary or a tertiary amine, a said terminal residue comprising a moiety selected from the group consisting of primary amine, hydroxyl, carboxyl, and thiol, and wherein in the presence of a substance comprising a hydroxyl group or amine group, said activated dendrimer polyamine covalently binds said substance through said hydroxyl group or amine group.

2. The surface of claim 1, wherein said surface is glass.

3. The glass surface of claim 2, wherein said glass surface is a glass slide.

4. The surface of claim 1, wherein said surface is a synthetic polymer material selected from the group consisting polypropylene, nylon, poly-styrene, poly-carbonate or other plastic polymer slides, poly-styrene, poly-carbonate or other plastic polymer well plates, beads, membranes, and glass wool.

5. The surface of claim 1, wherein said silane containing moiety has the formula

$$XR'Si(OR'')_3$$

wherein R' is alkyl containing 0-10 carbons, R" is alkyl containing 1-10 carbons, X is selected from the group consisting of NH_2, SH, OH, CN, halogen, methacrylate, quaternary amine salt, carboxylic acid and carboxylic acid salt, phosphonate, succinic anhydride, 2-carbomethoxyaziridine, dihydroimidazole, thiocyanato, isocyanato, isopropeno, 2,3-epoxypropoxy, and epoxy-alkyl.

6. The surface of claim 1, wherein said dendrimer polyamine comprises $[6]^n$ terminal primary amine groups, wherein n=1, 2, 3, or 4.

7. The surface of claim 1, wherein said dendrimer polyamine comprises $[15]^n$ terminal primary amine groups, wherein n=1, 2, 3, or 4.

8. The surface of claim 1, wherein said dendrimer polyamine comprises $[31]^n$ terminal primary amine groups, wherein n=1, 2, 3, or 4.

9. The surface of claim 1, wherein said dendrimer polyamine comprises $[63]^n$ terminal primary amine groups, wherein n=1, 2, 3, or 4.

10. The surface of claim 1, wherein said substance comprising a hydroxyl group or amine group is selected from the group consisting of DNA, RNA, polypeptides.

11. The surface of claim 1, wherein said substance comprising a hydroxyl or amine group is covalently bonded to said dendrimer polyamine.

12. The surface of claim 1, wherein said surface is chemically stable at room temperature.

13. The surface of claim 12, wherein said surface is chemically stable at room temperature for at least three months.

14. The surface of claim 1, wherein said dendrimer polyamine comprises amide linkages between any two successive dendrimer generations and comprises a secondary or tertiary amine at a branch point that does not contain said amide linkage, wherein a branch of said dendrimer polyamine comprises a carbon-carbon bond, a carbon-oxygen-carbon bond, or a carbon-nitrogen-carbon bond.

15. A kit comprising a chemically reactive surface reactive with a substance comprising a hydroxyl group or amine group, comprising:

a solid surface having an activated dendrimer polyamine covalently bonded to said surface through a silane containing moiety, said dendrimer polyamine comprising branch points and terminal residues, a said branch point of said dendrimer comprising either a secondary or a tertiary amine, a said terminal residue comprising a moiety selected from the group consisting of primary amine, hydroxyl, carboxyl, and thiol, and wherein in the presence of a substance comprising a hydroxyl group or amine group, said activated dendrimer polyamine covalently binds said substance through said hydroxyl group or amine group; and

packaging materials therefore.

16. A kit comprising a chemically reactive surface reactive with a substance comprising a hydroxyl group or amine group, comprising:

a solid surface having an activated dendrimer polyamine covalently bonded to said surface through a silane containing moiety, said dendrimer polyamine comprising branch points and terminal residues, a said branch point of said dendrimer comprising either a secondary or a tertiary amine, a said terminal residue comprising a moiety selected from the group consisting of primary amine, hydroxyl, carboxyl, and thiol, and wherein said substance comprising a hydroxyl group or an amine group is covalently bonded to said dendrimer polyamine; and

packaging materials therefore.

17. The kit of claim 15 or 16, wherein said surface is glass.

18. The glass surface of claim 17, wherein said glass surface is a glass slide.

19. The kit of claim 15 or 16, wherein said surface is a synthetic polymer material selected from the group consisting polypropylene, nylon, poly-styrene, poly-carbonate or other plastic polymer slides, poly-styrene, poly-carbonate or other plastic polymer well plates, beads, membranes, and glass wool.

20. The kit of claim 15 or 16, wherein said silane containing moiety has the general formula

$$XR'Si(OR'')_3$$

wherein R' is alkyl containing 0-10 carbons, R" is alkyl containing 1-10 carbons, X is selected from the group consisting of NH2, SH, OH, CN, halogen, methacrylate, quaternary amine salt, carboxylic acid and carboxylic acid salt, phosphonate, succinic anhydride, 2-carbomethoxyaziridine, dihydroimidazole, thiocyanato, isocyanato, isopropeno, 2,3-epoxypropoxy, and epoxy-alkyl.

21. The surface of claim 15 or 16, wherein said dendrimer polyamine comprises $[6]^n$ terminal primary amine groups, wherein n=1, 2, 3, or 4.

22. The surface of claim 15 or 16, wherein said dendrimer polyamine comprises $[15]^n$ terminal primary amine groups, wherein n=1, 2, 3, or 4.

23. The surface of claim 15 or 16, wherein said dendrimer polyamine comprises $[31]^n$ terminal primary amine groups, wherein n=1, 2, 3, or 4.

24. The surface of claim 15 or 16, wherein said dendrimer polyamine comprises $[63]^n$ terminal primary amine groups, wherein n=1, 2, 3, or 4.

25. The kit of claim 15 or 16, wherein said substance comprising a hydroxyl group or amine group is selected from the group consisting of DNA, RNA, and polypeptides.

26. The kit of claim 15 or 16, wherein said surface is chemically stable at room temperature.

27. The kit of claim 15 or 16, further comprising nucleic acid printing buffer.

28. The kit of claim 15 or 16, further comprising polypeptide printing buffer.

29. The kit of claim 15 or 16, further comprising a nucleic acid hybridization solution.

30. The kit of claim 15 or 16, further comprising deactivating solution.

31. The kit of claim 15 or 16, further comprising a nucleic acid stripping solution

32. The kit of claim 15 or 16, wherein said glass slide is maintained in an anhydrous state until contacted with a nucleic acid, or polypeptide and/or a nucleic acid or polypeptide printing buffer.

33. A method of making a chemically reactive surface which is reactive with a substance comprising a hydroxyl group or amine group, comprising:

(a) contacting said surface with a silane containing moiety comprising a reactive functionality, under conditions to produce a silanized surface;

(b) contacting said silanized surface with a reagent containing a terminally unsaturated carbon which chemically reacts with said reactive functionality to produce a surface capable of reacting with an amine group containing compound;

(c) reacting the surface with a first amino group containing compound having the formula $NH_2(CH_2)_mY[(CH_2)_nY]_x(CH_2)_mNH_2$, wherein m,n equals 1-15, x equals 4-15, and Y is O, or NH;

(d) contacting said first amino group containing compound with a reagent containing a terminally unsaturated carbon to produce a surface capable of reacting with an amine group containing compound;

(e) reacting said reagent containing a terminally unsaturated carbon with a second amino group containing compound to produce a first dendrimer generation;

(f) sequentially repeating the above steps (b) and (e) on the silanized surface so as to generate polyamine dendrimer that is chemically bonded to said surface comprising $[6]^n$ terminal primary amine groups, wherein n=1, 2, 3, 4, 5, or 6;

(g) reacting said surface with a reagent which activates said amine groups so as to render said surface reactive with a substance comprising a hydroxyl group or amine group;

wherein after each of steps (a) - (g), said surface is dried.

34. The method of claim 33, wherein said reactive functionality is an amine group.

35. The method of claim 33, wherein said silane containing moiety has the general formula

$$XR'Si(OR'')_3$$

wherein R' is alkyl containing 0-10 carbons, R" is alkyl containing 1-10 carbons, X is selected from the group consisting of NH2, SH, OH, CN, halogen, methacrylate, quaternary amine salt, carboxylic acid and carboxylic acid salt, phosphonate, succinic anhydride, 2-carbomethoxyaziridine, dihydroimidazole, thiocyanato, isocyanato, isopropeno, 2,3-epoxypropoxy, and epoxy-alkyl.

36. The method of claim 33, wherein said reagent containing a terminally unsaturated carbon is selected from the group consisting of acryloylchloride, 4-nitrophenyl-chloroformate, acryloyliodide, acryloylbromide, 4-nitrophenyl-chloroformate, 4-nitrophenyl-bromoformate, 4-nitrophenyl-iodoformate, CH_2=CRC(O)Cl, CHR=CHC(O)Cl, RR'C=CHC(O)Cl, CH_2=CH$(CH_2)_n$C(O)Cl, wherein R or R' equals 1-15 carbons and n equals 0-10.

37. The method of claim 33, wherein said second amine group containing compound is selected from the group consisting of: tetraethylenpentamine, 1,4-bis-(3-aminopropoxy)butane, 4-aminomethyl-1,8-octadiamine, 4,7,10-trioxa-1,13-tridecandiamine, N,N-dimethyl-1,6-hexadiamine, 2-(2-aminoethoxy)ethanol, jeffamine 130, 3-amino-1,2-propandiol, hesandiamine, cyclohexandiamine, pentaethylenehexamine, polyethylenepolyamine, and $NH_2(CH_2CH_2NH)_nCH_2CH_2NH_2$, wherein n=2, 4, 5-12.

38. The method of claim 33, wherein said reagent which activates said amine groups is selected from the group consisting of: phenylendiisothiocyanate, disuccinimidylcarbonate, pheynylendiisocyanate, disuccinimidyloxalate, bis-2-succinimido-oxycarbonyloxyethyl sulfone (BSOCOES), sulfo-BSOCOES, bis-sulfosuccinimidyl-disuccinimidyl tartarate (DST), sulfo-DST, ethylene glycol bis-succinimidylsuccinate (EGS), and dimethylsuberimidate.

39. The method of claim 33, wherein said reagent which activates said amine groups is phenylendiisothiocyanate.

40. A method of making a chemically reactive surface which is reactive with a substance comprising a hydroxyl group or amino group, comprising:

(a) contacting said surface with a silane containing moiety comprising a reactive functionality, under conditions to produce a silanized surface;

(b) contacting said silanized surface with a reagent containing a terminally unsaturated carbon which chemically reacts with said reactive functionality to produce a surface capable of reacting with a dendrimer polyamine;

(c) reacting said silanized surface with a dendrimer polyamine selected from the group consisting of polypropylenimine hexadecaamine, polypropylenimine tetraamine dendrimer, polypropylenimine octaamine dendrimer, polypropylenimine hexadecaamine dendrimer, polypropylenimine dotriacontaamine dendrimer, or polypropylenimine tetrahexacontaamine dendrimer, wherein said dendrimer polyamine comprises terminal primary amine groups;

(d) sequentially repeating the above steps (b) and (c) on the silanized surface so as to generate polyamine dendrimer that is chemically bonded to said surface comprising $[5]^n$, $[15]^n$, $[31]^n$, or $[63]^n$ terminal primary amine groups, wherein n=1, 2, 3, or 4; and

(e) reacting said surface with a reagent which activates said terminal primary amine groups so as to render said surface reactive with said substance comprising a hydroxyl group or amine group;

wherein after each of said contacting or reacting steps said surface is dried.

41. The method of claim 40, wherein said reactive functionality is an amine group.

42. The method of claim 40, wherein said silane containing moiety has the general formula

$$XR'Si(OR'')_3$$

wherein R' is alkyl containing 0-10 carbons, R" is alkyl containing 1-10 carbons, X is selected from the group consisting of NH2, SH, OH, CN, halogen, methacrylate, quaternary amine salt, carboxylic acid and carboxylic acid salt, phosphonates, succinic anhydride, 2-carbomethoxyaziridine, dihydroimidazole, thiocyanato, isocyanato, isopropeno, 2,3-epoxypropoxy, and epoxy-alkyl.

43. The method of claim 40, wherein said reagent containing a terminally unsaturated carbon is acryloylchloride, 4-nitrophenyl-chloroformate, acryloyliodide, acryloylbromide, 4-nitrophenyl-chloroformate, 4-nitrophenyl-bromoformate, 4-nitrophenyl-iodoformate $CH_2=CRC(O)Cl$, $CHR=CHC(O)Cl$, $RR'C=CHC(O)Cl$, or $CH_2=CH(CH_2)_nC(O)Cl$, wherein R or R' equals 1-15 carbons and n equals 0-10.

44. The method of claim 40, wherein said reagent which activates said amino groups is phenylendiisothiocyanate, disuccinimidylcarbonate, pheynylendiisocyanate, disuccinimidyloxalate, bis-2-succinimido-oxycarbonyloxyethyl sulfone (BSOCOES), sulfo-BSOCOES, bis-sulfosuccinimidyl-disuccinimidyl tartarate (DST), sulfo-DST, ethylene glycol bis-succinimidylsuccinate (EGS), dimethylsuberimidate, or other homo- or hetero-bifunctional cross linking reagents.

45. The method of claim 33 or 40, further comprising the step of reacting said surface with said substance comprising a hydroxyl group or amine group.

46. The method of claim 45, wherein after said step of reacting said surface with said substance comprising a hydroxyl group or amine group, said surface is reusable for at least three biochemical reactions.